UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/065,331	10/04/2002	Pierino Bonanni	121601-1	2194

23413 7590 05/28/2004

CANTOR COLBURN, LLP
55 GRIFFIN ROAD SOUTH
BLOOMFIELD, CT 06002

EXAMINER	
LE, JOHN H	
ART UNIT	PAPER NUMBER
2863	

DATE MAILED: 05/28/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No. 10/065,331	Applicant(s) BONANNI ET AL.
	Examiner John H Le	Art Unit 2863

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6,11,23-26 and 29-32* is/are rejected.

7)☒ Claim(s) *7-10,12-16,18-22,27 and 28* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *02 December 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *03/31/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. This office action is in response to applicant's response received on 03/22/2004.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

3. Claims 1-6, 11, 23-26, and 29-32 are rejected under 35 U.S.C. 102(e) as being anticipated by Andrew et al. (USP 6,438,484)

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in

the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Regarding claims 1, 5, 11, 23, and 32, Andrew et al. teaches a system for detecting precursors to compressor stall/surge 14 comprising at least one sensor 30 positioned at said compressor 14 (Fig.2) to monitor at least one compressor parameter (e.g. Col.5, lines 20-37), said at least one sensor outputting raw data representative of said at least one compressor parameter (e.g. Col.5, lines 38-44). Andrew et al. disclose the dynamic pressure data collected by sensor(s) 30 is provided to a calibration system 32 for data processing. The calibration system includes an electronic processing unit with associated data and program storage units, and input and output devices. The processing step includes filtering the collected pressure data to remove noise, and time-series, and spectral analysis of the data. It will be appreciated that the present invention should not be construed to limited to time-series and frequency domain analysis. The calibration system may include an A/D (analog-to-digital) converter for digitizing the time-series data. When the amount of stored data received from sensors 30 reaches a predetermined level, a stall precursor detection algorithm embodied in system 33 processes the digitized data received from calibration system 32 and extracts magnitudes of the stall precursors by processing such signal characteristics as, for example, amplitude, rate of change of the monitored parameter, spectral content, etc. The extracted signal characteristics identified as stall precursor measure are combined with similar stall precursor measures measured by each of a plurality of sensors(s) 30. The combined stall measures are stored in the data storage system 31. <u>Sensor data</u>

may also be processed using a plurality of stall precursor detection algorithms operating in parallel, thus increasing the confidence of stall precursor detection. Stall precursor detection algorithms may include such algorithms based on known mathematical techniques such as, for example, Kalman Filter, temporal Fast Fourier Transform (FFT), Chaotic Series, Frequency Demodulation, Correlation Integral, etc. Voting between results obtained via various algorithms as noted above may also be determined. The combined magnitude of the stall measure stored in storage device 31 is compared in a comparator 43 with a stall precursor magnitude of a similar compressor (referred herein as "unit specific characteristic") received and stored in a look-up-table (LUT) 44 to define an upper limit of compressor degradation. The look-up-table 44 is also populated with an average stall precursor magnitude (referred herein as "fleet characteristic") of compressors similar to compressor 14. The LUT 44 is populated with the gas turbine compressor unit specific characteristics and average characteristics on a dynamic basis. Furthermore, historical stall precursor data of a compressor may also be stored in storage device 31, and the current level of compressor operability is compared with a prior level of operability to determine compressor degradation (Col.5, line 52-Col.6, line 30).

Although Andrew et al. is silent on the teaching of the claimed a frequency demodulator receiving said raw data, demodulating said raw data, and producing demodulated data; and a Kalman filter obtaining stall precursors from said demodulated data, this feature is seen to be an inherent teaching of that devices since the processing step includes filtering the collected pressure data to remove noise, and time-series, and

spectral analysis of the data. It will be appreciated that the present invention should not be construed to limited to time-series and frequency domain analysis. The calibration system may include an A/D (analog-to-digital) converter for digitizing the time-series data. When the amount of stored data received from sensors 30 reaches a predetermined level, a stall precursor detection algorithm embodied in system 33 processes the digitized data received from calibration system 32 and extracts magnitudes of the stall precursors by processing such signal characteristics. The sensor data may also be processed using a plurality of stall precursor detection algorithms operating in parallel, thus increasing the confidence of stall precursor detection. Stall precursor detection algorithms may include such algorithms based on known mathematical techniques such as, for example, Kalman Filter, Frequency Demodulation, that some type of a frequency demodulator receiving said raw data, demodulating said raw data, and producing demodulated data; and a Kalman filter obtaining stall precursors from said demodulated data must be present for providing a system for detecting precursors to compressor stall/surge as intended.

Regarding claims 17, although Andrew et al. is silent on the teaching of the claimed the Kalman filter computes a filtered estimate of locally dominant components of the preprocessed data, this feature is seen to be an inherent teaching of that devices since the sensor data may also be processed using a plurality of stall precursor detection algorithms operating in parallel, thus increasing the confidence of stall precursor detection. Stall precursor detection algorithms may include such algorithms based on known mathematical techniques such as, for example, Kalman Filter,

Frequency Demodulationthat some type of the Kalman filter computes a filtered estimate of locally dominant components of the preprocessed data must be present for providing a system for detecting precursors to compressor stall/surge as intended.

Regarding claim 26, although Andrew et al. is silent on the teaching of the claimed a pre-filter to reject undesirable signals from said raw data prior to being input into said frequency demodulator, this feature is seen to be an inherent teaching of that steps since the processing step includes filtering the collected pressure data to remove noise, and time-series, and spectral analysis of the data, that some type of a pre-filter to reject undesirable signals from said raw data prior to being input into said frequency demodulator must be present for providing a system for detecting precursors to compressor stall/surge as intended.

Regarding claims 29 and 30, although Andrew et al. is silent on the teaching of the claimed demodulator operates on said raw data in the analog domain and demodulator operates on said raw data in the digital domain, this feature is seen to be an inherent teaching of that steps since the sensor data may also be processed using a plurality of stall precursor detection algorithms operating in parallel, thus increasing the confidence of stall precursor detection. Stall precursor detection algorithms may include such algorithms based on known mathematical techniques such as, for example, Kalman Filter, Frequency Demodulation, that some type of demodulator operates on said raw data in the analog domain and demodulator operates on said raw data in the digital domain must be present for providing a system for detecting precursors to compressor stall/surge as intended.

Regarding claim 31, although Andrew et al. is silent on the teaching of the claimed a low-pass filter filtering the demodulated data to reduce noise interference prior, this feature is seen to be an inherent teaching of that device since the processing step of the electronic processing unit includes filtering the collected pressure data to remove noise, that some type of a low-pass filter filtering the demodulated data to reduce noise interference prior must be present for providing a system for detecting precursors to compressor stall/surge as intended.

Regarding claims 2, 24, Andrew et al. teach at least one compressor parameter comprises one or more of a static pressure sensor sensing a static pressure of the gasses flowing through the compressor, a dynamic pressure sensor sensing a dynamic pressure of the gasses flowing through the compressor; a velocity sensor sensing a velocity of the gasses flowing through the compressor; and a forces and vibrations sensor sensing forces and vibrations exerted on a casing of said compressor (e.g. Col.3, lines 14-18, Col.5, lines 20-37).

Regarding claims 3-4, Andrew et al. teach monitoring dynamic pressure at least one location within said compressor and monitoring dynamic pressure at a plurality of locations within said compressor (e.g. Fig.2, Col.5, lines 32-37).

Regarding claims 6, 25, Andrew et al. teach a calibration system for sampling and digitizing output from said at least one sensor to obtain time-series analyzed raw data, said frequency demodulator receiving said time-series analyzed raw data (e.g. Col.5, line 52-Col.6, line 6).

Allowable Subject Matter

4. Claims 7-10, 12-16, 18-22, and 27-28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 7, none of the prior art of record teaches or suggests the combination of a method for detecting precursors to compressor stall/surge, wherein the method comprising: monitoring at least one compressor parameter to obtain raw data representative of said at least one compressor parameter; pre-processing said raw data using a frequency demodulator to produce preprocessed data, said pre-processing being at least partially performed in the digital domain; and post-processing said pre-processed data using a Kalman filter to obtain stall precursors; wherein said pre-processing comprises: pre-filtering time-series analyzed data obtained from said at least one compressor parameter to reject undesirable signals; frequency demodulating the filtered signal to produce a demodulated signal having an amplitude corresponding to the instantaneous frequency of a locally dominant component of the input signal, and low pass filtering the demodulated signal to reduce noise interference. It is these limitations as they are claimed in the combination, which have not been found, taught or suggested in the prior art of record, that make these claims allowable over the prior art.

Regarding claim 12, none of the prior art of record teaches or suggests the combination of a method for detecting precursors to compressor stall/surge, wherein the method comprising step of: monitoring at least one compressor parameter to obtain raw

data representative of said at least one compressor parameter; pre-processing said raw data using a frequency demodulator to produce preprocessed data, said preprocessing being performed at least partially in the analog domain; post-processing said pre-processed data using a Kalman filter to obtain stall precursors; wherein said pre-processing comprises: pre-filtering time-series signals representing said at least one compressor parameter to reject undesirable signals; frequency demodulating the filtered signal to produce a demodulated signal having an amplitude corresponding to the instantaneous frequency of a locally dominant component of the input signal; and low pass filtering the demodulated signal to reduce noise interference to produce preprocessed signals. It is these limitations as they are claimed in the combination, which have not been found, taught or suggested in the prior art of record, that make these claims allowable over the prior art.

Regarding claim 18, none of the prior art of record teaches or suggests the combination of a method for detecting precursors to compressor stall/surge, wherein the method comprising steps of: monitoring at least one compressor parameter to obtain raw data representative of said at least one compressor parameter; pre-processing said raw data using a frequency demodulator to produce preprocessed data; post-processing said pre-processed data using a Kalman filter to obtain stall precursors; wherein the Kalman filter computes a filtered estimate of locally dominant components of the preprocessed data; wherein computing a standard deviation of innovations of said Kalman filter to determine a stall precursor signal. It is these limitations as they are

claimed in the combination, which have not been found, taught or suggested in the prior art of record, that make these claims allowable over the prior art.

Regarding claim 27, none of the prior art of record teaches or suggests the combination of a system for detecting precursors to compressor stall/surge, wherein the system comprising: at least one sensor positioned at said compressor to monitor at least one compressor parameter, said at least one sensor outputting raw data representative of said at least one compressor parameter; a frequency demodulator receiving said raw data, demodulating said raw data, and producing demodulated data; a Kalman filter obtaining stall precursors from said demodulated data; wherein the system further comprising a pre-filter to reject undesirable signals from said raw data prior to being input into said frequency demodulator, wherein said pre-filter comprises a band-pass filter centered on a locally dominant component of the input signal. It is these limitations as they are claimed in the combination, which have not been found, taught or suggested in the prior art of record, that make these claims allowable over the prior art.

Response to Arguments

5. Applicant's arguments filed 03/22/2004 have been fully considered but they are not persuasive.

-Applicant argues that the prior did not teach “a frequency demodulator receiving said raw data, demodulating said raw data, and producing demodulated data; and a Kalman filter obtaining stall precursors from said demodulated data” as in claims 1, 5, 11, and 23.

Although Andrew et al. is silent on the teaching of the claimed a frequency demodulator receiving said raw data, demodulating said raw data, and producing demodulated data; and a Kalman filter obtaining stall precursors from said demodulated data, this feature is seen to be an inherent teaching of that devices since the processing step includes filtering the collected pressure data to remove noise, and time-series, and spectral analysis of the data. It will be appreciated that the present invention should not be construed to limited to time-series and frequency domain analysis. The calibration system may include an A/D (analog-to-digital) converter for digitizing the time-series data. When the amount of stored data received from sensors 30 reaches a predetermined level, a stall precursor detection algorithm embodied in system 33 processes the digitized data received from calibration system 32 and extracts magnitudes of the stall precursors by processing such signal characteristics. The sensor data may also be processed using a plurality of stall precursor detection algorithms operating in parallel, thus increasing the confidence of stall precursor detection. Stall precursor detection algorithms may include such algorithms based on known mathematical techniques such as, for example, Kalman Filter, Frequency Demodulation, that some type of a frequency demodulator receiving said raw data, demodulating said raw data, and producing demodulated data; and a Kalman filter obtaining stall precursors from said demodulated data must be present for providing a system for detecting precursors to compressor stall/surge as intended.

Conclusion

6. Specifically Andrew et al. has been added to second ground of rejection.

Contact Information

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to John H Le whose telephone number is 571-272-2275. The examiner can normally be reached on 9:00 - 5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John E Barlow can be reached on 571-272-2269. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

John H. Le
Patent Examiner-Group 2863
May 20, 2004

BRYAN BUI
PRIMARY EXAMINER